

FLORA OF SANDY COAST OF GANJAM DISTRICT, ORISSA, INDIA

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This paper deals with the systematic account of plants from the sandy coast of Ganjam district of Orissa, and reports 175 species of angiosperms under 134 genera belonging to 61 families. The specimens were deposited in the Herbarium of the P.G. Department of Botany, Berhampur University, Berhampur (BOTB). Poaceae was the dominant family followed by Euphorbiaceae, Cyperaceae, Fabaceae and Asteraceae. Families were arranged according to the modified Bentham and Hooker's system of classification. The native species are represented by 155 species (89%), whereas the exotic species are represented by 20 species (11%), of which 16 species (9% of the total) are naturalized in the area. *Ceropegia candelabrum* – a species hitherto reported from inland is now reported from the coastal area. *Bulbostylis subspinescens* and *Micrococca mercurialis* are reported after 85 years of their first collection from the coast.

Key words: strand flora, angiosperms, native and exotic species, Ganjam district, Orissa, sandy coast

INTRODUCTION

Orissa has a coastline of 481 km and is rich in strand flora and forests. Coastal Orissa harbours littoral and tidal forests (Champion and Seth 1968). However, these forests have been degraded to a large extent due to various biotic interferences. Ganjam, one of the six coastal districts of Orissa, bordering Andhra Pradesh on the south, is represented by sandy coasts and devoid of tidal forests. The strand flora of Ganjam coast has not been studied in detail even though some sporadic reports on it are available (Rao 1971; Brahmam and Saxena 1980; Subudhi *et al.* 2002). The FLORA OF THE PRESIDENCY OF MADRAS (Gamble 1915-1936) refers to the plants of the district, but Haines (1921-1925) and Mooney (1950) did not include the plants of the district in their floras. Brahmam and Saxena (1980) mentioned some sand dune plants of Ganjam coast in their Ganjam flora. The present paper covers the sandy coastal flora of Ganjam district in Orissa.

MATERIAL AND METHODS

Ganjam district lies between 18° 58' to 20° 17' N and 84° 06' to 85° 11' E. The coast of Ganjam is bounded by Srikakulam district of Andhra Pradesh on the south and Puri district of Orissa on the north; the coast line runs over 64 km long along the Bay of Bengal (Fig. 1). The Chilika lake, the largest brackish water lagoon of Asia is located on the extreme north-east of the district. Rushikulya, the biggest river of Ganjam, discharges its waters into the Bay of Bengal and the estuarine zone is famous for the annual visit of thousands of Olive Ridley *Lepidochelys olivacea* turtles to the shore for

nesting. The district experiences a climate when near the sea with an active south-west monsoon and the average annual rainfall at Gopalpur is 1,296 mm. Relative humidity is high (64-86%) throughout the year.

Ganjam coast is famous for the Kewda *Pandanus fascicularis* used in perfume industry. There are about 120 distillation units (*bhatties*) in the coastal area that extract kewda essence from the male flowers (Sahu and Misra 2007). Moreover, Indian Rare Earth (IRE) Limited and Gopalpur port are situated in the Ganjam coast.

An extensive floristic survey of the sandy coast of Ganjam district was conducted during 2007-2009. The plants were collected from different localities along the coast during different seasons. Specimens collected were dried and preserved with saturated mercuric chloride solution in ethyl alcohol (Jain and Rao 1977). The specimens were identified with the help of the local floras (Haines 1921-1925; Gamble 1915-1936; Saxena and Brahmam 1994-1996) and the voucher specimens were deposited in the Herbarium of the Department of Botany, Berhampur University (BOTB), Orissa, India. The field number cited after the scientific names of the plants are of M.K. Misra, D. Sahu and R.C. Sahoo. The specimens collected are arranged in a tabular form indicating the family, flowering period and growth form. The families are arranged according to modified Bentham and Hooker's system (1862-1883) of classification and under each family the species are arranged alphabetically.

RESULTS

The present study reports a total number of 175 species of angiosperms from the sandy coast of Ganjam district, Orissa

Table 1: Plant species found in the strand flora of Ganjam district, Orissa, India

| Family | Name of the taxa | Flowering period | Growth form |
|-----------------|--|-------------------|-------------|
| Annonaceae | <i>Annona squamosa</i> L.; 573 | Mar.-May | T |
| | <i>Polyalthia suberosa</i> (Roxb.) Thw.; 475 | Apr.-May | T |
| Menispermaceae | <i>Tinospora cordifolia</i> (Willd.) Hook.f. & Thoms.; 587 | Aug.-Dec. | L |
| Capparaceae | <i>Cleome viscosa</i> L.; 578 | May-Oct. | H |
| Violaceae | <i>Hybanthus enneaspermus</i> (L.) F.v.Muell.; 533 | Throughout year | H |
| Caryophyllaceae | <i>Polycarpha corymbosa</i> (L.) Lam.; 546 | Nov.-Feb. | H |
| Portulacaceae | <i>Portulaca quadrifida</i> L.; 1508 | Most part of year | H |
| Malvaceae | <i>Abutilon indicum</i> (L.) Sweet subsp. <i>indicum</i> ; 597 | Jul.-Apr. | S |
| | <i>Sida acuta</i> Burm.f.; 515 | Sep.-May | H |
| | <i>Sida cordata</i> (Burm.f.) Borssum; 1534 | Jul.-Dec. | H |
| | <i>Sida cordifolia</i> L.; 70 | Aug.-Dec. | H |
| Sterculiaceae | <i>Waltheria indica</i> L. var. <i>indica</i> ; 509 | Aug.-Jan. | H |
| Tiliaceae | <i>Grewia tilifolia</i> Vahl; 1516 | Apr.-Jun. | T |
| | <i>Triumfetta rhomboidea</i> Jacq.; 1075 | Jul.-Jan. | H |
| Zygophyllaceae | <i>Tribulus terrestris</i> L.; 1011 | Throughout year | H |
| Oxalidaceae | <i>Oxalis corniculata</i> L.; 173 | Throughout year | H |
| Rutaceae | <i>Toddalia asiatica</i> (L.) Lam.; 600 | Aug.-Apr. | S |
| Meliaceae | <i>Azadirachta indica</i> A.Juss.; 572 | Feb.-May | T |
| Celastraceae | <i>Cassine glauca</i> (Rottb.) Kuntze; 271 | Sep.-Dec. | T |
| Rhamnaceae | <i>Ziziphus mauritiana</i> Lam.; 594 | Aug.-Oct. | T |
| | <i>Ziziphus oenoplia</i> (L.) Mill.; 1515 | Jun.-Sep. | S |
| Vitaceae | <i>Cissus quadrangula</i> L.; 53 | Apr.-Jan. | S |
| | <i>Cissus vitiginea</i> L.; 376 | Jul.-Oct. | L |
| Sapindaceae | <i>Cardiospermum halicacabum</i> L.; 113 | Apr.-Nov. | H |
| Anacardiaceae | <i>Anacardium occidentale</i> L.; 1025 | Feb.-Apr. | T |
| | <i>Lannea coromandelica</i> (Houtt.) Merr.; 177 | Mar.-Apr. | T |
| Caesalpinaceae | <i>Caesalpinia bonduc</i> (L.) Roxb.; 125 | Aug.-Oct. | L |
| | <i>Cassia occidentalis</i> L.; 542 | Aug.-Nov. | S |
| | <i>Cassia tora</i> L.; 62 | Sep.-Nov. | H |
| | <i>Tamarindus indica</i> L.; 98 | Apr.-Jun. | T |
| Fabaceae | <i>Abrus precatorius</i> L.; 218 | Aug.-Sept. | S |
| | <i>Alysicarpus vaginalis</i> (L.) DC.; 13 | Sep.-Jan. | H |
| | <i>Atylosia scarabaeoides</i> (L.) Benth.; 279 | Aug.-Jan. | H |
| | <i>Crotalaria umbellata</i> Wight ex Wight & Arn.; 498 | Oct.-Dec. | H |
| | <i>Crotalaria pallida</i> Ait.; 1062 | Jul.-Apr. | H |
| | <i>Desmodium biarticulatum</i> (L.) F.v. Muell.; 513 | Aug.-Nov. | H |
| | <i>Desmodium triflorum</i> (L.) DC.; 251 | Most part of year | H |
| | <i>Tephrosia purpurea</i> (L.) Pers. var. <i>maritima</i> Haines; 34 | Most part of year | H |
| | <i>Tephrosia villosa</i> (L.) Pers.; 310 | Jul.-Apr. | H |
| | <i>Vigna trilobata</i> (L.) Verdc.; 585 | Sep.-Feb. | H |
| | <i>Zornia diphylla</i> (L.) Pers.; 1034 | Aug.-Oct. | H |
| Mimosaceae | <i>Acacia auriculiformis</i> A.Cunn. ex Benth.; 122 | Throughout year | T |
| Myrtaceae | <i>Syzygium cumini</i> (L.) Skeels; 570 | Mar.-Apr. | T |
| Lythraceae | <i>Ammannia baccifera</i> L.; 270 | Sep.-Nov. | H |
| Onagraceae | <i>Ludwigia perennis</i> L.; 577 | Oct.-Nov. | H |
| Passifloraceae | <i>Passiflora foetida</i> L.; 1536 | Aug.-Nov. | H |
| Cucurbitaceae | <i>Coccinia grandis</i> (L.) Voigt; 06 | Most part of year | H |
| Cactaceae | <i>Opuntia stricta</i> (Haw.) Haw.; 200 | Jun.-Sep. | S |
| Molluginaceae | <i>Glinus lotoides</i> L.; 1537 | Feb.-May | H |
| | <i>Glinus oppositifolius</i> (L.) A.DC.; 326 | Mar.-Oct. | H |
| | <i>Mollugo pentaphylla</i> L.; 12 | Throughout year | H |
| Apiaceae | <i>Centella asiatica</i> (L.) Urban; 599 | Most part of year | H |
| Rubiaceae | <i>Hedyotis graminifolia</i> L. f. subsp. <i>arenaria</i> (Haines) Deb & Dutta; 1047 | Aug.-Nov. | H |
| | <i>Hedyotis herbacea</i> L.; 508 | Aug.-Jan. | H |

Table 1: Plant species found in the strand flora of Ganjam district, Orissa, India (*contd.*)

| Family | Name of the taxa | Flowering period | Growth form |
|------------------|---|-------------------|-------------|
| | <i>Hedyotis puberula</i> (G.Don) Arn.; 74 | Sep.-Mar. | H |
| | <i>Hydrophylax maritima</i> L. f.; 1066 | Feb.-Nov. | H |
| | <i>Morinda pubescens</i> Sm.; 1501 | Apr.-Jul. | T |
| | <i>Pavetta crassicaulis</i> Bremek.; 539 | Jun.-Aug. | S |
| | <i>Spermacoce articularis</i> L. f.; 521 | Jul.-Oct. | H |
| | <i>Spermacoce hispida</i> L.; 1018 | Jul.-Dec. | H |
| Asteraceae | <i>Chromolaena odorata</i> (L.) R. King & H.Robins.; 528 | Oct.-Dec. | S |
| | <i>Eclipta prostrata</i> (L.) L.; 112 | Aug.-Apr. | H |
| | <i>Emilia sonchifolia</i> (L.) DC.; 131 | Aug.-Apr. | H |
| | <i>Grangea maderaspatana</i> (L.) Poir.; 107 | Jan.-Apr. | H |
| | <i>Launaea sarmentosa</i> (Willd.) Schult-Bip. ex Kuntze; 04 | Mar.-Nov. | H |
| | <i>Mikania micrantha</i> Kunth; 590 | Jan.-Mar. | L |
| | <i>Parthenium hysterophorus</i> L.; 102 | Oct.-Apr. | H |
| | <i>Tridax procumbens</i> L.; 1058 | Throughout year | H |
| | <i>Vernonia cinerea</i> (L.) Less.; 1053 | Most part of year | H |
| Primulaceae | <i>Anagallis arvensis</i> L.; 304 | Jun.-Mar. | H |
| Sapotaceae | <i>Manilkara zapota</i> (L.) P.Royen; 541 | Apr.-Jul. | T |
| Salvadoraceae | <i>Azima tetracantha</i> Lam.; 305 | Mar.-May | S |
| Apocynaceae | <i>Carissa carandas</i> L.; 591 | Mar.-Apr. | S |
| | <i>Catharanthus roseus</i> (L.) G. Don; 536 | Throughout year | H |
| | <i>Holarrhena pubescens</i> (Buch.-Ham.) Wall.ex G.Don; 118 | May-Jul. | T |
| | <i>Ichnocarpus frutescens</i> (L.) R.Br.; 105 | Sep.-Dec. | L |
| Asclepiadaceae | <i>Calotropis gigantea</i> R.Br.; 239 | Dec.-Jul. | S |
| | <i>Ceropegia candelabrum</i> L.; 1519 | Aug.-Oct. | L |
| | <i>Hemidesmus indicus</i> (L.) R.Br.; 564 | Aug.-Oct. | L |
| | <i>Pergularia daemia</i> (Forssk.) Chiov.; 59 | Aug.-Dec. | L |
| | <i>Tylophora indica</i> (Burm.f.) Merr.; 1026 | Aug.-Oct. | L |
| Boraginaceae | <i>Heliotropium indicum</i> L.; 154 | Most part of year | H |
| Convolvulaceae | <i>Evolvulus alsinoides</i> (L.) L.; 209 | Jul.-Feb. | H |
| | <i>Evolvulus nummularius</i> (L.) L.; 1056 | Jul.-Nov. | H |
| | <i>Ipomoea campanulata</i> L.; 158 | Nov.-Feb. | L |
| | <i>Ipomoea pes-caprae</i> (L.) R.Br.; 09 | Most part of year | L |
| | <i>Merremia tridentata</i> (L.) Hall. f. subsp. <i>tridentata</i> ; 151 | Feb.-Nov. | H |
| Solanaceae | <i>Physalis minima</i> L.; 1502 | Aug.-Jan. | H |
| | <i>Solanum trilobatum</i> L.; 88 | Throughout year | L |
| | <i>Solanum viarum</i> Dunal; 1006 | Most part of year | H |
| | <i>Solanum virginianum</i> L.; 1005 | Throughout year | H |
| Scrophulariaceae | <i>Lindernia anagallis</i> (Burm. f.) Pennell; 324 | May-Dec. | H |
| | <i>Lindernia caespitosa</i> (Bl.) Panig.; 93 | Aug.-Dec. | H |
| | <i>Lindernia ciliata</i> (Colsm.) Pennell; 99 | Sep.-Nov. | H |
| Pedaliaceae | <i>Pedaliium murex</i> L.; 03 | Aug.-Nov. | H |
| Acanthaceae | <i>Asystasia gangetica</i> (L.) T. Anders.; 374 | Oct.-Dec. | H |
| Verbenaceae | <i>Clerodendrum inerme</i> (L.) Gaertn.; 484 | Most part of year | S |
| | <i>Lantana camara</i> L. var. <i>aculeata</i> (L.) Mold.; 545 | Throughout year | S |
| | <i>Phyla nodiflora</i> (L.) Greene; 596 | Most part of year | H |
| Lamiaceae | <i>Geniosporum tenuiflorum</i> (L.) Merr.; 391 | Jun.-Oct. | H |
| | <i>Hyptis suaveolens</i> (L.) Poit.; 56 | Sep.-Jan. | H |
| | <i>Leucas lanata</i> Benth.; 463 | Oct.-Dec. | H |
| | <i>Ocimum basilicum</i> L.; 54 | Sep.-Jan. | H |
| Nyctaginaceae | <i>Boerhavia diffusa</i> L.; 10 | Most part of year | H |
| Amaranthaceae | <i>Achyranthes aspera</i> L.; 275 | Oct.-Feb. | H |
| | <i>Aerva lanata</i> (L.) Juss. ex Sch.; 103 | Aug.-Jan. | H |
| | <i>Allmania nodiflora</i> (L.) R.Br. ex Wight; 34 | Jul.-Dec. | H |
| | <i>Alternanthera sessilis</i> (L.) R.Br. ex DC.; 84 | Jul.-Jan. | H |
| | <i>Amaranthus viridis</i> L.; 1003 | Throughout year | H |

Table 1: Plant species found in the strand flora of Ganjam district, Orissa, India (contd.)

| Family | Name of the taxa | Flowering period | Growth form |
|------------------|--|-------------------|-------------|
| Chenopodiaceae | <i>Suaeda maritima</i> (L.) Dumort; 393 | Apr.-Dec. | H |
| Polygonaceae | <i>Antigonon leptopus</i> Hook. & Arn.; 24 | Throughout year | L |
| Aristolochiaceae | <i>Aristolochia indica</i> L.; 17 | Jul.-Oct. | L |
| Lauraceae | <i>Cassytha filiformis</i> L.; 08 | Oct.-Nov. | H |
| Euphorbiaceae | <i>Acalypha indica</i> L.; 47 | Jul.-Dec. | H |
| | <i>Breynia vitis-idaea</i> (Burm.f.) Fischer; 41 | Mar.-Feb. | S |
| | <i>Croton bonplandianus</i> Baill.; 64 | Throughout year | H |
| | <i>Euphorbia hirta</i> L.; 276 | Throughout year | H |
| | <i>Euphorbia rosea</i> Retz.; 1015 | Feb.-Oct. | H |
| | <i>Euphorbia tirucalli</i> L.; 520 | Jul.-Oct. | S |
| | <i>Jatropha curcas</i> L.; 83 | May-Oct. | S |
| | <i>Jatropha gossypifolia</i> L.; 79 | Jul.-Oct. | S |
| | <i>Micrococca mercurialis</i> (L.) Benth.; 35 | Aug.-Sep. | H |
| | <i>Phyllanthus fraternus</i> Webster; 501 | Apr.-Jan. | H |
| | <i>Phyllanthus reticulatus</i> Poir.; 512 | Most part of year | S |
| | <i>Phyllanthus rotundifolius</i> Klein ex Willd.; 1016 | May-Oct. | H |
| | <i>Phyllanthus urinaria</i> L.; 370 | Jul.-Oct. | H |
| | <i>Phyllanthus virgatus</i> Forst. f.; 336 | Jul.-Feb. | H |
| | <i>Ricinus communis</i> L.; 181 | Most part of year | S |
| | <i>Sebastiania chamaelea</i> (L.) Mull.-Arg.; 581 | Most part of year | H |
| Moraceae | <i>Ficus benghalensis</i> L. var. <i>benghalensis</i> ; 72 | Apr.-Jun. | T |
| | <i>Ficus religiosa</i> L.; 80 | Jul.-Oct. | T |
| | <i>Streblus asper</i> Lour.; 372 | Mar.-Apr. | T |
| Casuarinaceae | <i>Casuarina equisetifolia</i> L.; 1031 | Apr.-May | T |
| Agavaceae | <i>Agave americana</i> L.; 534 | Apr.-May | S |
| Liliaceae | <i>Asparagus racemosus</i> Willd.; 1527 | Sep.-Oct. | H |
| | <i>Gloriosa superba</i> L.; 51 | Sep.-Nov. | H |
| Commelinaceae | <i>Commelina benghalensis</i> L.; 196 | Jul.-Jan. | H |
| Arecaceae | <i>Borassus flabellifer</i> L.; 15 | Mar.-May | T |
| | <i>Cocos nucifera</i> L.; 46 | Throughout year | T |
| | <i>Phoenix sylvestris</i> (L.) Roxb.; 332 | May-Oct. | T |
| Pandanaceae | <i>Pandanus fascicularis</i> Lam.; 116 | Jul.-Sep. | S |
| Typhaceae | <i>Typha angustata</i> Bory & Chaub.; 1067 | Most part of year | H |
| Cyperaceae | <i>Bulbostylis barbata</i> (Rottb.) C.B.Cl.; 124 | Jul.-Nov. | G |
| | <i>Bulbostylis subspinescens</i> C.B.Cl.; 465 | Jul.-Dec. | G |
| | <i>Cyperus arenarius</i> Retz.; 20 | Jul.-May | G |
| | <i>Cyperus compressus</i> L.; 40 | Jul.-Dec. | G |
| | <i>Cyperus iria</i> L.; 43 | Aug.-Jan. | G |
| | <i>Cyperus paniceus</i> (Rottb.) Boeck.; 390 | Jul.-Aug. | G |
| | <i>Cyperus polystachyos</i> Rottb.; 29 | Feb.-Oct. | G |
| | <i>Cyperus rotundus</i> L. subsp. <i>rotundus</i> ; 50 | Jul.-Dec. | G |
| | <i>Cyperus stoloniferus</i> Retz.; 52 | Oct.-Feb. | G |
| | <i>Cyperus triceps</i> Endl.; 55 | May.-Dec. | G |
| | <i>Eleocharis atropurpurea</i> (Retz.) Presl.; 58 | Aug.-Dec. | G |
| | <i>Fimbristylis acuminata</i> Vahl; 583 | Jul.-Nov. | G |
| | <i>Fimbristylis aestivalis</i> (Retz.) Vahl; 548 | Apr.-May | G |
| | <i>Fimbristylis ferruginea</i> (L.) Vahl; 592 | Apr.-Oct. | G |
| | <i>Fimbristylis ovata</i> (Burm.f.) Kern; 575 | Jun.-Dec. | G |
| Poaceae | <i>Aristida setacea</i> Retz.; 164 | Aug.-Feb. | G |
| | <i>Arundo donax</i> L.; 1007 | Oct.-Dec. | G |
| | <i>Bambusa arundinacea</i> (Retz.) Willd.; 266 | ? | T |
| | <i>Bothriochloa bladhii</i> (Retz.) S.T. Blake; 273 | Aug.-Feb. | G |
| | <i>Brachiaria distachya</i> (L.) Stapf; 19 | Sep.-Dec. | G |
| | <i>Chloris barbata</i> Sw.; 119 | Sep.-Jan. | G |
| | <i>Cynodon dactylon</i> (L.) Pers.; 91 | Most part of year | G |

Table 1: Plant species found in the strand flora of Ganjam district, Orissa, India (contd.)

| Family | Name of the taxa | Flowering period | Growth form |
|--------|---|-------------------|-------------|
| | <i>Dactyloctenium aegyptium</i> (L.) P. Beauv.; 42 | Sep.-Mar. | G |
| | <i>Digitaria ciliaris</i> (Retz.) Koeler; 27 | Jun.-Apr. | G |
| | <i>Digitaria longiflora</i> (Retz.) Pers.; 156 | Jul.-Dec. | G |
| | <i>Eragrostis ciliaris</i> (L.) R.Br.; 162 | Most part of year | G |
| | <i>Eragrostis coarctata</i> Stapf; 38 | Sep.-Apr. | G |
| | <i>Eragrostis japonica</i> (Thunb.) Trin; 148 | Oct.-Jan. | G |
| | <i>Eragrostis tremula</i> (Lam.) Hochst. ex Steud.; 23 | Jul.-Dec. | G |
| | <i>Oplismenus burmannii</i> (Retz.) P. Beauv.; 215 | Oct.-Nov. | G |
| | <i>Perotis indica</i> (L.) Kuntze; 1514 | Aug.-Nov. | G |
| | <i>Spinifex littoreus</i> (Burm.f.) Merr.; 1080 | Sep.-Feb. | G |
| | <i>Sporobolus indicus</i> (L.) R.Br. var. <i>diander</i> (Retz.) Jovet & Guedes; 26 | Jun.-Feb. | G |

G-Grass, H-Herb, L- Liana, S-Shrub, T-Tree, ?-Not observed

(Table 1). These taxa belong to 134 genera distributed among 61 Angiosperm families. The monocots constitute 24% of the total species (Table 2).

The 10 dominant families of the coastal flora were represented by 96 species (55% of the total species). The most dominant family was Poaceae (18 species) followed by Euphorbiaceae (16 species), Cyperaceae (15 species), Fabaceae (11 species), Asteraceae (9 species) and Rubiaceae (8 species).

The floristic components are classified into five growth forms (i) grasses and sedges, (ii) herbs, (iii) shrubs, (iv) woody climbers (lianas) and (v) trees. The highest number of species (49%) was grouped under herbs; grasses and sedge were represented by 18% of the species. Trees and shrubs were represented by 13% and 12% of species, respectively. The woody climbers constituted 8% of species.

The part of the beach that lies between the ordinary low and high tide is included under foreshore. All the species observed in this region are native. The foreshore consists of stabilized and unstabilized sand dunes. The heights of the stabilized sand dunes ranged between 10 to 15 m and harbour *Cyperus arenarius*, *Spinifex littoreus*, *Ipomoea pes-caprae* and *Launaea sarmentosa*. The unstabilized sand dunes are mostly covered with dense patches of *Hydrophylax maritima*, *Sesuvium portulacastrum* and *Digitaria longiflora*.

Table 2: Floristic analysis of strand flora of Ganjam district, Orissa, India

| Taxa | Monocotyledons | Dicotyledons | Total |
|----------|----------------|--------------|------------|
| Families | 8 (13%) | 53 (87%) | 61 (100%) |
| Genera | 27 (20%) | 107 (80%) | 134 (100%) |
| Species | 42 (24%) | 133 (76%) | 175 (100%) |

The foreshore ranges from 0.5 to 1.0 km from the water line along the coast. The width of the backshore ranges between 0.5 and 1.0 km from foreshore towards interior. Backshore flora consists of a mixture of native, naturalized, exotic and some cultivated native species. Exotic species such as *Anacardium occidentale*, *Casuarina equisetifolia* and *Cocos nucifera* are planted in the backshore area. *Pandanus fascicularis* is also often cultivated in the area. *Ammonia squamosa*, *Cleome viscosa*, *Cassia tora*, *Opuntia stricta*, *Chromolaena odorata*, *Parthenium hysterophorus*, *Lantana camara* var. *aculeata*, *Hyptis suaveolens*, *Croton bonplandianus*, *Jatropha gossypifolia*, *Jatropha curcas* are some of the examples of naturalized alien species that invaded the coast.

DISCUSSION

Rao (1971) has divided internal distribution pattern of the Indian maritime strand flora into three types – one type includes those plants showing complete fidelity to inner strand, the second type encompasses plants of mid/outer strand under the maritime influence, and the third type consists of plants from strand to inland extension. Out of the first type only the sand strand flora is observed in the district and rock strand is absent. The interesting elements of this strand flora are *Cyperus arenarius*, *Ipomoea pes-caprae*, *Hydrophylax maritima*, *Sesuvium portulacastrum* and *Spinifex littoreus* (Table 1).

Rao (1971) while reporting strand flora of India cited 75 species of angiosperms for Orissa coast. Most of these species mentioned by Rao are from the northern part of Orissa and 21 species reported in the paper have also been included in Rao's list of 75 species. The taxa reported by Subudhi *et*

al. (2002) for Orissa coast does not cover Ganjam coast.

Ceropegia candelabrum, a climber reported many years ago from the interior part of the state (Khurda and Dhani area of Khurda district) by Haines and Mooney, is now recorded from the vicinity of *Casuarina equisetifolia* plantations of the sandy coast of Ganjam district.

Bulbostylis subspinescens and *Micrococca mercurialis* were reported from Puri and Konark sandy coast by Haines (1921-1925) and are new records for Ganjam sandy coast. These species have been considered as threatened taxa by Saxena and Brahmam (1994-1996), but on the coast of Ganjam these species are common.

The coastal flora is an admixture of native as well as exotic species. Out of the total 175 species, 155 species (89%) are native including 3 (2%) species which are planted. The exotic species in the area are represented by 20 species (11%) of which 16 species (9% of the total) have already been naturalized in the area (Table 1).

Although the exotic species are very few in number, they have invaded the coastal areas to an extent that they have now become a threat to the growth of native species. *Antigonon leptopus*, *Chromolaena odorata*, *Hyptis suaveolens* and *Parthenium hysterophorus* are the most notorious invasive aliens. The loss of native flora in the coast may be due to habitation and privatization of common property resources of the coastal villages (Sahoo and Misra 1994) and industrialization. The industries such as Indian Rare Earth Limited, hatcheries, Gopalpur port and such other activities in the Ganjam coast pose a threat for the very survival of strand flora.

The aged beefwood (*Casuarina equisetifolia*) plantations in the coast provides a congenial environment for the growth of many species such as *Aristolochia indica*, *Asystasia gangetica*, *Ceropegia candelabrum*, *Coccinia grandis*, *Emilia sonchifolia*, *Hybanthus enneaspermus*, *Micrococca mercurialis*, *Pergularia daemia*, *Sida cordifolia*, *Solanum trilobatum* and *Tylophora indica*. *Azadirachta indica*, *Lannea coromandelica* and *Morinda pubescens* are also common within the beefwood plantation and seeds of these species are usually dispersed by birds.

The plant resources of the coast of Ganjam district are



Fig.1: Map showing the coastal Ganjam district, Orissa, India

ecologically and economically very important. Different components of Screw pine *Pandanus fascicularis*, a semi-natural plant, are used by the local people (Panda *et al.* 2000-2001) for various purposes. The male flowers of the kewda plant yield perfume (kewda scent, kewda oil and kewda water), worth millions of rupees (Sahu 2004; Sahu and Misra 2007). Coconut *Cocos nucifera* and Cashew nut *Anacardium occidentale* are important economic resources of the area. The creeping stem of *Cyperus arenarius*, a native species on the sands, is utilized to prepare traditional rope. Stem, leaf and branches of many of the species, such as *Calotropis gigantea*, *Cassia occidentalis*, *Chromolaena odorata*, *Lantana camara* var. *aculeata*, and Screw pine *Pandanus fascicularis* and Palmyra palm *Borassus flabelifer* are used as fuel.

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